Into the Redwood Forest
An Inquiry Science Investigation at Muir Woods National Monument

Overview

How do we experience natural places?

This essential question frames *Into the Redwood Forest* and is meant to allow students to engage in place-based inquiry science at Muir Woods National Monument. The essential question:

1. Reflects the essence of what they will study without directing them to one correct answer.
2. Provokes "how" or "why" questions rather than "what" questions.
3. Applies to places beyond Muir Woods.
4. Invites discussion from everyone based on both experience and understanding.

Students conduct their own science investigation in which they learn about natural places, forest ecology, habitat, and species interdependence through inquiry. Students pose questions, search for evidence, and suggest explanations. The program provides a tangible model for students to explore a redwood forest through learning activities in the classroom and in a National Park (Muir Woods).

Program Goals

- Provide a place-based Science education program that is inquiry-based, tied to the curriculum, and based on cooperative learning.
- Promote an understanding of the significance of Muir Woods and how and why the National Park Service preserves and protects this old-growth forest.
- Serve as an outdoor classroom in which students can learn about the historical, cultural, and environmental forces that shape and influence Muir Woods, and prompt students to consider similar issues and values in their own neighborhood.
- Foster a personal connection to their local national park.
- Create a space for healthy physical activity to be fun and educational.

Program Objectives

- Students will be engaged in science-based inquiry investigations.
- Students will communicate evidence and construct reasonable explanations (spoken or written).
- Students will know what safety measures to consider when walking on park trails.
- Students will know the basics of the Leave No Trace philosophy.

Ties to the Curriculum – Science Content and Skills for 3rd and 4th Grades

Life Sciences:

- Adaptations in physical structure or behavior may improve an organism's chance for survival.
- Living organisms depend on one another and on their environment for survival.

Investigation and Experimentation:

- Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in other three strands, students should develop their own questions and perform investigations.

English Language/Arts:

- Writing Strategies, Writing Applications, Written and Oral Language Conventions, and Listening and Speaking Strategies as students record their observations in their notebooks, work in cooperative learning groups, articulate their findings, and learn and apply new vocabulary words.

Program Logistics:

Please take careful note of the following:

- The teacher and adult chaperones are ultimately responsible for the conduct and safety of the students.
- Clothing appropriate to the nature of the activities and weather conditions at the park is required. Advise students to dress in layers to accommodate the variable temperature characteristic of the woods. The program will go on regardless of weather conditions. The park has enough raincoats to provide for an entire class if needed.
- The class should be split in half. Students from each group should have a work partner in their group to confer with during the exploration.
- Arrangements can be made to accommodate students with special needs. Please discuss specific circumstances with National Park Service staff prior to your visit.
- Please distribute the parental approval forms and photo/video release forms to students at least a week before the woods visit.

Rules and Regulations

There are park rules and regulations that your class should be made aware of before their visit. Please share the following rules with them:

- The class will stay on the main trail at all times, unless directed by park representative to do otherwise.
- No plants or other natural features can be removed from the park.
- Feeding or disturbing animals is not allowed.
- Portable radios, musical instruments, and electronic games will not be allowed on the field session.

Cancellation Policy

Please let us know of any changes in rescheduling your program dates. Because of the volume of schools participating, there is little room to reschedule your original date. Please plan accordingly.

Directions

Most classes will be taking buses to Muir Woods. Bus companies are familiar with the route.

For those classes that will be carpooling:
Muir Woods National Monument is located on the South Side of Mount Tamalpais, 12 miles North of San Francisco. Take Highway 101 to Mill Valley in Marin County. Take the Stinson Beach / Highway 1 exit. Follow the signs to Muir Woods.

Note: The narrow, winding road leading to the park is not accessible by vehicles larger than 35 feet, according to the regulation of the California Highway Patrol (CHP). There is no public transportation to the park.

Program Description – *Into the Redwood Forest*

The program has three elements: pre-visit classroom lessons provided by the teacher and NPS staff; a field session at Muir Woods facilitated by NPS and assisted by adult chaperones; and suggested post-visit lessons guided by the teacher.

Perspectives – Teacher Facilitated Lessons

Students read a short biography of John Muir and discuss aspects of his life, and consider his understanding of natural spaces. They then create personalized nature journals to record their own thoughts and ideas throughout the program. They then complete a vocabulary crossword puzzle and discuss their questions and answers. Complete the lessons by showing a brief fun video that introduces students to the sights, sounds, and mysteries of Muir Woods.

Time

Determined by class

Materials

John Muir biography
Recyclable paper
Cardboard
Two-Hole punch
Rubber Bands
Stick or Pencil
Vocabulary list
Crossword puzzle and answer sheet
DVD video introducing Muir Woods

Activity One

Ask the students to read the brief story of John Muir. John Muir, deeply moved by the beauty of nature, wrote his personal feelings, encounters, and observations in his field journals throughout his life. Likewise, students may be personally moved by things they learn in class and at Muir Woods. Have a discussion on what they read and about the value (private and public) of keeping a journal.

Have each student create his or her own personalized journal. You may want to use the blank side of recyclable paper and cardboard for the back. The students may want to design their own cover. Punch two holes in the top and thread a rubber band through the holes. Use a stick or pencil to hold it in place. This journal will serve as each student's account of his or her learning activities, reflections, feelings and observations while participating in *Into the Redwood Forest*.

Activity Two

Take students outside of the classroom to an area on school grounds that could be considered natural. In small groups of three or four, have students make a list of the natural and human made elements they see in the area. Upon returning to the classroom, have each group share their observations. Afterwards, facilitate a discussion about what does or doesn't make a place natural. Consider how adding or removing certain elements may influence the place's natural aura.

Activity Three

Divide the students into 5 small groups. Assign each group a set of vocabulary words (without definitions.) Ask them to work together to create a possible definition for each of the words. Have the class compile all of their definitions. Distribute the class vocabulary list to each student.

Distribute the crossword puzzle to each student. Ask the students to work in their smaller groups to solve the puzzle. Tell them to refer to their vocabulary list to help them. They will compare their own definitions with the clues for the crossword. Ask them to complete as much of the puzzle as possible.

Review each of the vocabulary words with the class. Have students share their understanding of the words and ask other students to add to the definition. They may want to modify their original definitions to reflect their new ideas. We have provided a teacher's copy of the vocabulary list for you to consult.

Activity Four

Ask the students to take out their journals. Have them record three things they expect to see in the forest, and ask them to record two questions they have about Muir Woods based on their understanding of the vocabulary list. Have a discussion about the elements Muir Woods may or may not have in common with the place visited in Activity Two.

Activity Five

Watch the eight-minute DVD introducing Muir Woods. Afterwards, have students share their thoughts about the natural elements of Muir Woods and what new questions they have about the forest.

John Muir – A Biography

Muir Woods National Monument has lots of visitors each year who come to discover the beauty of an ancient redwood forest. Many of those visitors ask the rangers, "What is a Muir?" Well, a Muir is not a thing, but a very important person who dedicated his life to writing and informing people of the wonders of nature.

John Muir, who the park is named for, was born in Dunbar Scotland in 1838. When he was 11 years old his family immigrated to the United States and settled in Wisconsin on land that they turned into a farm. They all worked very hard on the farm, sometimes working 16 hours in one day. John had a curiosity of the plants and animals that lived near his home. He also loved to read and would awake in the very early morning while his family slept so he would have the time. His favorite books were on mathematics.

John also was an inventor. He thought there was a better and easier way to do things. He invented a thermometer, clocks, and a bed called an "early-raising machine". It was a bed that worked like an alarm clock. When it was time to get up, the bed would rise and tip you onto the floor. Everyone was impressed with his inventions and encouraged him to go to the Wisconsin state fair in Madison to display them. So, at the age of 22, John left home and went to Madison. He was the hit of the fair. Newspaper articles were written about John and his amazing inventions.

John had a desire to continue his education and wanted to attend the University of Wisconsin, so he started to take jobs to save money for his education. He was accepted into the University and found that botany, the study of plants, was his favorite subject. At the university he made a good friend, Jeanne Carr, she had studied botany for many years. He stayed at the university for four years but his yearning to be in nature and finding and learning about plants started his journeys.

First John went to Canada and wandered and drew and wrote about the plants he saw in his journal. He moved to Indiana and needed to work to earn some money, so he got a job in a factory. One day while working on a machine a part flew off it and hit him in his eye. This made him go temporarily blind. The doctor told him he needed to stay out of the light for four months and his sight may come back. John was very fearful that he might never see the beauty of nature again and made a pact with himself, if his eyesight did come back, he would go on a trip and see and write about all the plants, his thoughts and adventures.

John's eyesight did return and he said good-bye to all his friends and family and left on a 1,000 mile walking trip from Indiana to Florida. All along the way he recorded in his journal

everything he saw and did. His journey did not end there. He then took a boat to Cuba and then a ship to San Francisco. He had read about the beauty of Yosemite Valley and desperately wanted to visit it. He arrived in San Francisco in 1868 and immediately started off for Yosemite.

John spent many years hiking around Yosemite and recording his thoughts and findings in his journal. He would send all his writings to his friend Jeanne Carr who lived in Oakland. She encouraged him to write about his journeys and what he had in his journals. So, John started writing very popular articles that were in many magazines. People from all over the country were reading and learning from his articles. President Theodore Roosevelt visited Yosemite and requested that John take him on a camping trip. Because of his writings and love of Yosemite, it is now a National Park.

John married and lived in Martinez, California with his wife and two daughters. They owned an orchard. It is now a National Historic Site that you can visit. He still traveled to new places continuing to keep his journal and writing about his travels.

When Muir Woods National Monument was named after him in 1908, John Muir was very honored. He said, "This is the best tree lover's monument that could possibly be found in all the forests of the world. You have done me great honor, and I am proud of it."

Biografía de John Muir

El Monumento Nacional del Bosque de Muir tiene muchos visitantes cada año que vienen a descubrir la belleza de un antiguo bosque de secuoyas. Muchos de estos visitantes preguntan a los guardabosques: "¿Qué es un muir?" Bueno, un muir no es una cosa, sino una persona muy importante que dedicó su vida a escribir e informar a la gente sobre las maravillas de la naturaleza.

John Muir, del cual recibe el nombre el parque, nació en Dunbar, Escocia, en 1838. Cuando él tenía 11 años su familia inmigró a los Estados Unidos y se instaló en Wisconsin, en una tierra que convirtieron en granja. Todos ellos trabajaron muy duro en la granja, a veces trabajando 16 horas al día. A John le producían curiosidad las plantas y los animales que vivían cerca de su casa. También le encantaba leer y se levantaba muy temprano de madrugada mientras su familia dormía para tener tiempo de leer. Sus libros favoritos eran de matemáticas.

John también era inventor. Él pensaba que había una manera mejor y más fácil de hacer las cosas. Inventó un termómetro, relojes y una cama llamada "máquina de madrugar". Era una cama que funcionaba como un despertador. Cuando era la hora de levantarse, la cama se alzaba y te tiraba al suelo. Todo el mundo estaba impresionado con sus inventos y le animaba a ir a la feria estatal de Wisconsin en Madison para mostrarlos. Así es que, a sus 22 años, John salió de su casa y se fue a Madison. Fue el éxito de la feria. Se escribieron artículos en los periódicos sobre John y sus increíbles inventos.

John quería seguir estudiando y asistir a la Universidad de Wisconsin, así es que empezó a agarrar trabajos para ahorrar dinero para sus estudios. Le aceptaron en la Universidad y se dio cuenta de que la botánica, el estudio de las plantas, era su asignatura favorita. En la universidad hizo una buena amiga, Jeanne Carr, que había estudiado botánica durante muchos años. Permaneció en la universidad durante cuatro años, pero su anhelo de estar en la naturaleza hallando plantas y aprendiendo cosas sobre ellas le llevó a dar comienzo a sus viajes.

Primero John fue a Canadá y deambuló y dibujó y escribió sobre las plantas que vio en su diario. Se trasladó a Indiana y necesitaba trabajar para ganar algo de dinero, así es que agarró un trabajo en una fábrica. Un día, mientras trabajaba en una máquina, una pieza salió volando y le dio en el ojo. Eso le dejó ciego temporalmente. El médico le dijo que tenía que estar sin ver la luz durante cuatro meses y que a lo mejor recuperaría la vista. John tenía mucho miedo de no poder volver a ver la belleza de la naturaleza e hizo un pacto consigo mismo: si recuperaba la vista, emprendería un viaje y escribiría sobre todas las plantas que viera, sus pensamientos y sus aventuras.

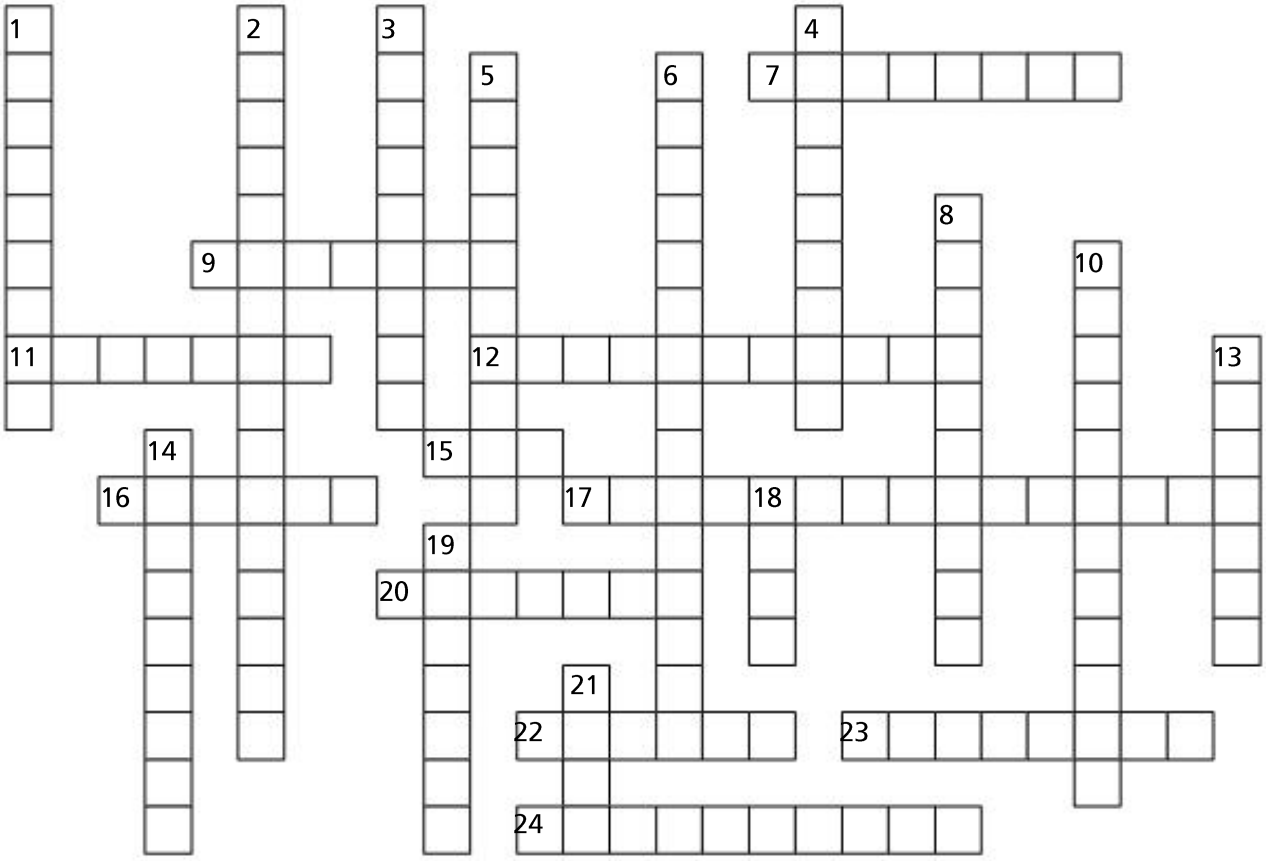
John recuperó la vista y se despidió de todos sus amigos y familiares y emprendió un viaje de 1000 millas a pie de Indiana a Florida. A lo largo de todo el camino tomó nota en su diario de todo lo que vio e hizo. Su viaje no terminó en Florida. De allá tomó una barca a

Cuba y luego un barco a San Francisco. Había leído cosas sobre la belleza del valle de Yosemite y tenía muchas ganas de visitarlo. Llegó a San Francisco en 1868 y se dirigió inmediatamente a Yosemite.

John se pasó muchos años caminando por Yosemite y apuntando sus pensamientos y sus hallazgos en su diario. Le mandaba todas sus notas a su amiga Jeanne Carr, quien para entonces vivía en Oakland. Ella le animó a que escribiera artículos sobre sus viajes y lo que veía usando sus diarios. Así, John empezó a escribir artículos muy famosos que salieron en muchas revistas. Gente de todas partes del país leía y aprendía de sus artículos. El presidente Theodore Roosevelt visitó Yosemite y solicitó que John le llevara de acampada. Debido a sus publicaciones y a su amor por Yosemite, ahora es un Parque Nacional.

John se casó y vivió en Martínez, California, con su esposa y sus dos hijas. Ellos tenían un huerto. Éste es ahora un Lugar de Interés Histórico Nacional que se puede visitar. Él siguió viajando a sitios nuevos y escribiendo en su diario sobre sus viajes.

Cuando le pusieron el nombre al Monumento Nacional del Bosque de Muir en 1908, John Muir se sintió muy honrado. Él dijo: "Éste es el mejor monumento a los amantes de los árboles que se pueda encontrar en todos los bosques del mundo. Me han hecho ustedes un gran honor y estoy orgulloso de ello".



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ACROSS

7 – A person who studies the science of plants.

9 – A place where living things live and are most likely to be found.

11 – To search for the purpose of discovery.

12 – The degree of hotness shown on a standard scale.

15 – Particles of water suspended in the air near the ground.

16 – The top layer of leaves and branches on the forest's tallest trees. The ceiling of the forest.

17 – A person that helps protect land and natural resources.

20 – To make available.

22 – A dense growth of trees and understory covering a large area.

23 – To keep in perfect or unaltered condition.

24 – A member of the ecosystem that recycles dead plants and animals by feeding on them.

DOWN

1 – All the living and nonliving parts in an area.

2 – Plants, animals, water, soil and other materials found in nature.

3 – The altitude of a place above sea level or ground level.

4 – A natural group living together, either plant, animal, human etc.

5 – Plant life

6 – Relationships among living things where all depend upon one another.

8 – The smaller trees and plants growing under the tallest trees.

10 – An area of scenic beauty or historical importance owned and protected by the American people.

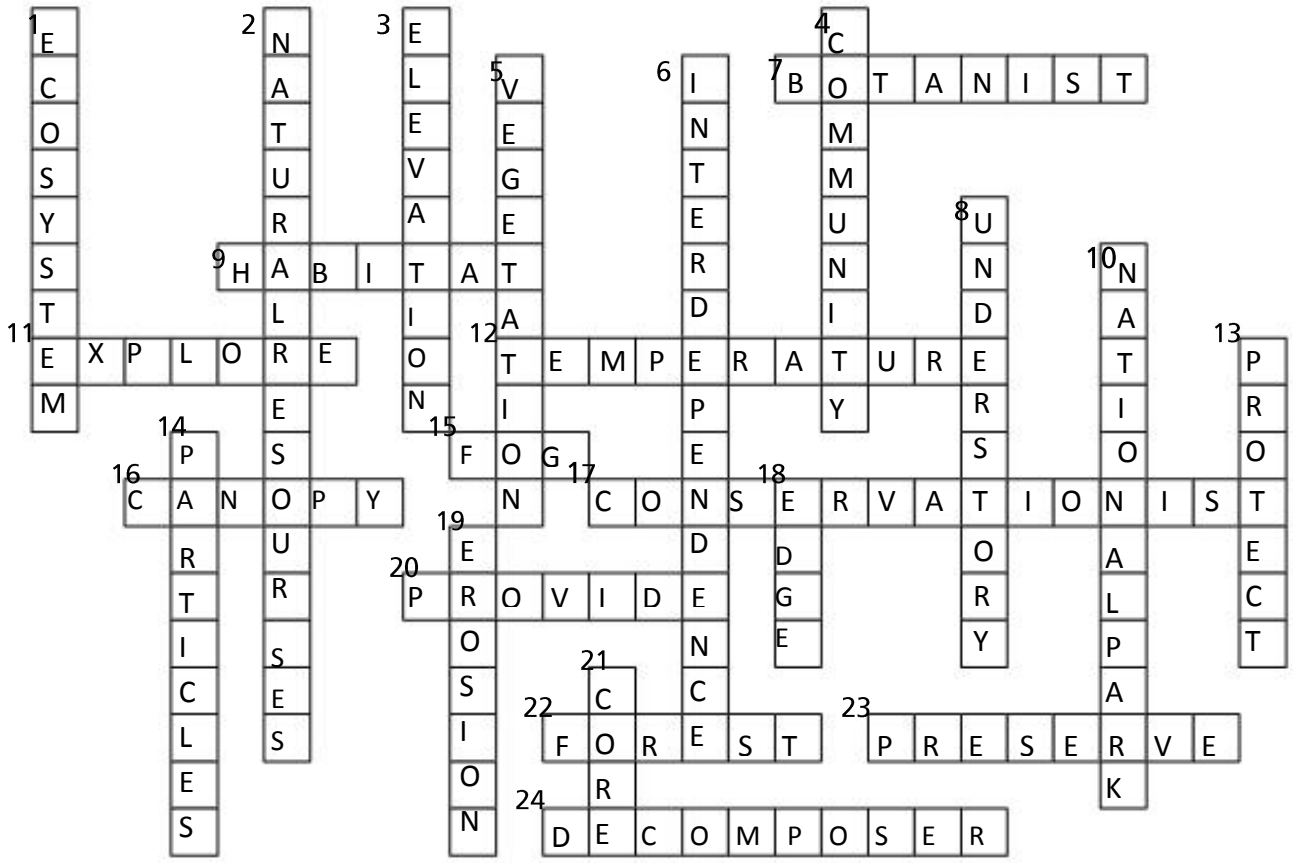
13 – To keep from being damaged or injured.

14 – Tiny or very small pieces of something

18 – The community on the outer most part of the forest. It is dry and warm and is at a higher elevation.

19 – To destroy by wearing away.

21 – The community that is the central most part of the forest. There is a low amount of light and a high population of tall trees.



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Vocabulary List:

Botanist: A person who studies the science of plants.

Canopy: The top layer of leaves and branches on the forest's tallest trees. The ceiling of the forest.

Community: A natural group living together, either plant, animal, human etc.

Conservationist: A person that helps protect land and natural resources.

Core: The community that is the central most part of the forest. There is a low amount of light and a high population of tall trees.

Decomposer: A member of the ecosystem that recycles dead plants and animals by feeding on them.

Ecosystem: All the living and nonliving parts in an area.

Edge: The community on the outer most part of the forest. It is dry and warm and is at a higher elevation.

Elevation: the altitude of a place above sea level or ground level.

Erosion: To destroy by wearing away.

Explore: To search for the purpose of discovery.

Fog: Particles of water suspended in the air near the ground.

Forest: A dense growth of trees and understory covering a large area.

Habitat: A place where living things live and are most likely to be found.

Interdependence: Relationships among living things where all depend upon one another.

National Park: an area of scenic beauty or historical importance owned and protected by the American people.

Natural Resources: Plants, animals, water, soil and other materials found in nature.

Particles: tiny or very small pieces of something

Preserve: To keep in perfect or unaltered condition.

Protect: To keep from being damaged or injured.

Provide: To make available.

Temperature: The degree of hotness shown on a standard scale.

Understory: The smaller trees and plants growing under the tallest trees.

Vegetation: Plant life

Muir Woods and You – NPS Facilitated Lesson

In your classroom park staff introduces the inquiry process (or reinforces if the class has been using inquiry methods) through small group work and an interactive power point presentation. This process mirrors what the students will do in the field session at Muir Woods.

Time
1 Hour

Materials
Nature Journals

Activity One
NPS staff engages students in a conversation about nature and what elements define a natural space. This will give the facilitator a sense of the types of questions and assumptions the students have about the redwood forest. These questions will be interwoven in the next two activities.

Activity Two
The NPS representative facilitates an interactive power point about Muir Woods focusing on scientific concepts – fire, adaptation, and decomposition – that students will observe and investigate during their park visit. Students share their questions and explanations. A facilitated discussion helps students predict what they will encounter in the woods and sees if they have begun to address their earlier questions.

Activity Three
The NPS representative facilitates a brief discussion on the NPS mission, and explains the basic logistics and rules for the field session.

Nature Detectives – Muir Woods Field Session

Summary
Students investigate the essential question in the woods through applied inquiry methods. Students record their observations, predictions, questions, and explanations. NPS staff facilitates discussions at each of the stops and at the conclusion of the program.

Time
3 hours on-site

Investigation in Muir Woods
NPS staff welcomes the students and reviews the safety rules. Staff then leads the small groups of students along the main Muir Woods trail. Chosen stops provide opportunities for the students to gather evidence about indigenous plants in the forest, the role and impact of fire, the relationship between decomposition and habitat, and the larger context of the redwood forest being an element in a watershed. They also experience a "silent solo walk," in which they can reflect on their thoughts and feelings about the redwood forest.

Students use their journals to record observations, predictions, questions, and explanations. They are provided with materials, such as plant identification guides, to assist them in the exploration. They also will recognize the elements of the forest that they identified and discussed in the classroom lesson.

Students share their questions and explanations with each other and the ranger. Using an inquiry approach, the ranger guides students to compare their pre-visit questions and assumptions with their new discoveries at Muir Woods National Monument, as well as consider areas for further inquiry-based scientific investigation.

Post-Visit Classroom Lessons

These follow-up activities are designed to build upon the students' inquiry experience at Muir Woods. Students can demonstrate what they have learned and how they have learned during their national park experience. Please conduct at least one of the following activities:

1. Have students create a tri-fold brochure or field guide that demonstrates through art their understanding of natural space in the forest in one column, and their understanding of human-affected space in the second column. In the third, students write about the similarities and differences between the two areas and present their brochures to the class during a teacher-facilitated discussion. This activity reinforces the concept of natural space in their home community. Students are encouraged to send the originals or copies to Muir Woods.

2. Students work in pairs to research a natural element (plant, animal, and/or abiotic) of the forest environment. Using art supplies, students create visuals depicting their element and explain its role in the natural space. Students assemble a class mural. Each work pair explains the role of their element in the larger forest ecology. The teacher helps facilitate the order of presentations so that the concept of what constitutes a natural space is reinforced. Students are encouraged to send the originals or copies to Muir Woods.

3. Divide the class into small groups. Have each group select a person or community group dedicated to preservation work of natural places in the San Francisco community. Have students read about them or, if possible, conduct an interview. Use a Jig-saw model to share information and answer questions based on their findings. Use this exercise for students to deepen abilities to conduct research, ask questions, communicate findings, and familiarize themselves with current local environmental action.

4. Divide the class into small groups. Have each group select a natural place in the San Francisco area to read about. As a group, the students describe the natural and non-natural elements of the place. Using their observations students determine what attracts people to the place and how they use the space. As a group, students present their findings with the rest of the class.

Assessment

An inquiry approach to the pre-visit classroom activities improves the field program: Students are focused on the careful inquiry of the forest, searching for answers to their questions, and are able to consider the essential question with greater confidence. We are able to conduct a simple assessment of students' experiences at the end of the field program by reviewing their notebooks in which students have written their questions, responses, and reflections.

1) **What makes a place natural?**
2) **Where can you find natural space in your own community?**

Further assessment is available to the teacher when students return to class and complete one of the post-visit lessons.